

## ELECTRICAL CONNECTOR (RECEPTACLE) WITH EASILY REMOVABLE BOTTOM

*Background of the Invention*

The present invention relates to a novel electrical connector that is attached to a printed circuit board by soldering, in which the connector is a receptacle usually, but not necessarily, arranged in an array, such as, a single row, dual row, triple row, dual-in-line, pin grid array or other configuration of grid. The receptacle has placed or formed within it a spring contact for mechanically gripping another connector which will be inserted into it. One end of the connector is sealed by a removable material which is resistant to the heat of the soldering and at the same time protects the spring contact from contamination with flux and liquid solder.

*Field of the Invention*

The present invention relates to the field of electrical connectors arranged in arrays for soldering to a printed circuit board. Printed circuit boards with arranged arrays of contact receiving orifices are the *sine qua non* of modern electronics including but not limited to computers of all types and descriptions, telecommunications equipment of all kinds, displays, television, radio, radar, sonar, toys for tots and so on. The list of the items which utilize this precise electrical interconnect structure is virtually endless. The universal problem with these interconnect devices is how to solder the connector to the circuit board without damaging the spring contact within the connector. Many solutions have been tried. Some worked effectively enough to protect the spring connector

1 but in so doing the opening at one end of the connector is  
2 itself sufficiently plugged as to make the connector useless or  
3 difficult to use for its intended purpose. The most common of  
4 those solutions was the use of a metallic "knock-out" bottom  
5 which required a separate tool to be inserted into each  
6 receptacle to remove the metal bottom forcibly, assuming of  
7 course that the receptacle bottom had not been soldered so well  
8 that it could not be dislodged at all or without breaking the  
9 connector or circuit board. These solutions are shown in data  
10 sheets of Amp, Mill-Max, and Cambion, copies of which are  
11 attached to this application as Information Disclosure Statement  
12 by Applicant.

#### 13 *Description of the Prior Art*

14 The closest prior art known to the applicant is shown by  
15 the attached Data Sheets. None of these teachings show either  
16 the physical structure or the function taught by the present  
17 invention. They show the use of a metal cover over one end of  
18 the receptacle which requires a metal tool to dislodge it, if it  
19 hasn't been soldered to the receptacle during the soldering  
20 process. If that happens it is difficult or even impossible to  
21 remove the cover.

#### 22 *Summary of the Invention*

23 The present invention teaches, in a number of embodiments,  
24 a novel structure and function of an array of connectors  
25 fastened to a planar insulator, usually formed of a high  
temperature thermoplastic. The planar insulator has a pattern  
of substantially cylindrical openings formed therein into which

1 is inserted a machined copper alloy sleeve which is plated with  
2 tin or tin-lead alloy. The sleeve itself is a hollow  
3 substantially cylindrical tube with a multi-finger spring  
4 contact inserted near one (usually called the upper end). The  
5 spring contact itself is plated with gold, tin, tin-lead or  
6 other malleable electrically conductive material. At the far  
7 end of the cylindrical tube is fixed a plug of "kraft paper" to  
8 function as a barrier, made from substantially pure wood pulp  
9 with no fillers. The cylindrical tube of the sleeve grips the  
10 kraft paper barrier sufficiently for it to remain in place  
11 during the processing cycle when the copper alloy sleeve is  
12 soldered to the circuit board. The "kraft paper" is stable and  
13 unaffected by the temperature to which the solder is heated to  
14 become fluid and can be easily removed by the insertion of a  
15 connector lead into the sleeve.

#### 16 Brief Description of the Drawings

17 Figures 1 shows in perspective a three layer circuit board  
18 assembly showing one embodiment of the invention

19 Figures 2 is a sectional view taken along the line 2-2  
20 shown in Figure 1 and shows the inter-connection pin in the  
21 sleeve and being gripped by the contact spring before pushing  
22 out the kraft paper barrier.

#### 23 Description of the Preferred Embodiment

24 Figure 1 is perspective view of a first embodiment of the  
25 present invention showing by the number 10, by way of example  
and not limitation, a three-layer circuit board assembly. The  
circuit boards are shown as parts 12, 112, 212 in which like

1 parts have like numbers preceded by the numeral 1 or 2. Each  
2 circuit board has an array of plated through orifices 14, 114,  
3 214 respectively. Interconnecting the circuit boards are  
4 sockets 80, 180 with interconnection pins 50, 150.

5 Each circuit board has an upper and lower surface 13, 15,  
6 113, 115, 213, 215 respectively as shown in Figure 1. The  
7 sockets 80, 180 have through channels 82, 182 into which are  
8 inserted interconnection pins 50, 150.

9 Looking at the detail shown in Figure 2 for the socket and  
10 interconnection pin portion of the invention is the socket  
11 insulator having a socket sleeve 190 inserted there through. A  
12 multi-finger spring contact 62, 162 formed from spring temper  
13 copper alloy which is inserted into the upper end of the socket  
14 sleeve. The lower end (as shown in the Figure) of the socket  
15 sleeve has in this embodiment a smaller diameter extension 192  
16 for soldering to the lowest circuit board 212.

17 The lower end of socket sleeve, more particularly the far  
18 end of the sleeve (opposite the end having the spring contact)  
19 has an edge formed by the taper of (normally) vertical outer  
20 side 170 which forms a sharp edge 174 at its near intersection  
21 with inner diameter surface 172 of the sleeve. This sharp edge  
22 surface of the sleeve captures the kraft paper plug 250 which  
23 forms the protective barrier for the sleeve during soldering.  
24 The soft, easily removable barrier 250 protects the inner sleeve  
25 and spring contact from flux vapor and molten solder during the  
operations which form the solder joints 220, 230 shown in Figure  
2. When the interconnection pin 150 is inserted into the sleeve